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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/950,038	09/10/2001	Eitan Zait	22868.49	8658

26418 7590 07/20/2004

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EXAMINER

ANGEBRANDT, MARTIN J

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 07/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/950,038	ZAIT ET AL.	
	Examiner	Art Unit	
	Martin J Angebranndt	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 5/12/2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 and 24-40 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 24-40 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 September 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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1. The response provided by the applicant has been read and given careful consideration.

Rejections of the previous office action not found below are withdrawn based upon the amendment and arguments of the applicant. Responses to the arguments of the applicant are found after the first rejection to which they are directed. The examiner has cited the patent issuing from the co-pending application. There is not a PTO -1449 corresponding to that referred to by the applicant on page 5 of the response in the record.

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2b Claims 1-12 and 24-28 and 30-40 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 25, the describes the target locations as within the coating layer (the exemplified coating is chrome, which is a light blocking , not a phase shifting layer) to form a phase shifting formation. (specification at [0040] in the prepub discussed the phase shifting area as in the proximity of the chrome layer). When the chrome layer is patterned, a phase shift is not formed. In claim 26, the shifting area is disclosed as “distanced from the coating layer” and no specification of target areas in the substrate, proximate to the coating. The claims is at best confusing and incomplete as no irradiation of the substrate (where the phase shifting occurs) is recited. See also claim 27 which specifies the phase shifting area as within the substrate. **The applicant should include the limitations of claim 29 in claim 25 to address this issue.**

In claim 1, please insert - - of the substrate- - after “subsurface region”.

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3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 25-28,30,31 and 35-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999), in view of Gelbart et al. '818.

Hongo et al. '759 teach the processing of photomasks to remove defects, where the laser passes through the transparent substrate and ablates the chrome layer. The apparatus is shown in figure 3 where the stage allows translation . The computer controls the stage, laser and the scanning gear. The backside irradiation is disclosed as preventing damage to the lens elements due to redeposition of the chrome (1/29-38). The backside irradiation also prevents alloying of the glass and metal (1/11-28). The back side irradiation is also disclosed as minimizing surface damage (roughness or pit formation) (1/43-50). The use of laser having pulsewidths of less than 20 nanoseconds is disclosed. (2/40-61). longer pulsewidths are disclosed as exhibiting undesirable thermal effects. (7/62-8/16). An argon ion laser was used. (488, 514.5 nm output, 3/43)

Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) teach with respect to figure 7, as apparatus which uses a femtosecond laser to ablate chrome defects without thermal effects, particularly thermal damage to the adjacent substrate (see figure 4, page 3137,

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right column and page 3140, left column). The ablation threshold for quartz is disclosed as much higher than that of Cr. (page 3140, left column). The computer controls the focussing through the objective turret and the condenser assembly as well as the stage location. (page 3142, left column). The use of a Ti:sapphire laser with an 800 nm output is disclosed. The pulses are 10 femtoseconds long. (page 3141, left column)

Gelbart et al. '818 teach ablation as a means for forming phase shift masks. In figure 4, the light absorbing polyimide layer (16) is placed beneath the overcoat (19). (3/53-63) In figure 5, a positive resist layer (20) is coated beneath the polyimide layer. (3/64-4/19). The prior art attempts to directly ablate chrome or polymer layers were hampered by the very short wavelengths required and the low repetition rate of the excimer lasers. The thickness of these layers is disclosed as facilitating a 180 degree phase shift ($\lambda/2n$) and may be in the range of 0.1 to 2 microns in thickness.

It would have been obvious to one of ordinary skill in the art to modify the process of Hongo et al. '759 by using the femtosecond lasers and computer controlled focusing of Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) to further decrease the thermal effects and allow the automation of the focusing as well with a reasonable expectation of gaining these advantages, particularly in view of the direction within Hongo et al. '759 to shorter laser pulses and/or it would have been obvious to one skilled in the art to modify the teachings of Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) by using the backside irradiation disclosed by Hongo et al. '759 to reduce the damage to the substrate, to reduce damage to the optics from

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redeposition of the chrome on the optics and alloying of the substrate and chrome with a reasonable expectation of success based upon the reference being in the same field of endeavor and the desirability of reducing unintentional damage to the substrate in both the references and further, the examiner holds that it would have been obvious to one skilled in the art to modify the invention of Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) by adding adjacent phase shifting layers to allow phase shift masks to be formed.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The issue is the obviousness of the combination of the references, each of which describe benefits due to either backside irradiation or ultrashort pulse lengths and one of ordinary skill in the art would clearly expect to combination of the teachings of the references to realize the ascribed benefits. The claims rejected under this heading do not require the phase shifting area to be within the substrate, but rather in the coating, which makes the argument seem divergent from the claimed invention. The applicant's arguments are only sensible when discussing the target areas of the focused beam being within the substrate as recited in claim 1. The reduced damage of the shorter (femtosecond) pulses is fully appreciated in the prior art of record and therefore cannot be relied upon as an basis for obviating a rejection under obviousness. The examiner notes that the nanojoule powers are not recited in the claims and therefore the scope of coverage sought is broader than the position argued. The examiner also notes that there is no language describing

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that no intravolume scattering centers are formed in the claims and therefore the argued position and claimed position are not commensurate in scope. Clearly, the fs pulses of Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) are ultrashort within the meaning of the claims.

5. Claims 25-28, 30-32 and 35-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongo et al. '759, Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) and Gelbart et al. '818, in view of Lou et al. '272.

Lou et al. '272 teach with respect to figures 2a-c, the use of AR films. The use of these in laser machining of chromium masks is disclosed. (7/10-23)

In addition to the basis provided above, the examiner holds that it would have been obvious to one skilled in the art to modify the combination of Hongo et al. '759, Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) and Gelbart et al. '818 by adding an AR coating as disclosed by Lou et al. '272 to be useful in laser machining of chromium masks.

The rejection stands without further comment beyond those presented above.

6. Claims 25-28 and 30-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over James et al. '200 combined with Hongo et al. '759, Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) and Gelbart et al. '818, in view of Jensen et al. '718.

James et al. '200 teaches with respect to figures 11, 13 and 15, a laser source (10), such as a YAG laser, which is divided into separate beams as indicated in figure 11 and focussed by the

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microlens array (14), which may be shifted as indicated by indicia (12?, with the arrows) and then the light is modulated using computer control using the transmissive device (26) shown in figure 13 or the reflective device (26a) shown in figure 15. The workpiece adjustment means (20a) shown in figure 1 also allows the workpiece to be shifted relative to the focus of the lenses. (5/8-19). The mask 22 or 22a may alternatively be computer controlled. (7/15-8/7). The individually controllable

Jensen et al. '718 (2/49-59) disclose the use of lasers to form masks.

It would have been obvious to one skilled in the art to modify the invention of James et al. '200 by providing computer control means for the stage holding the workpiece as taught by Hongo et al. '759, Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) and Gelbart et al. '818 with a reasonable expectation of gaining increased flexibility in forming the patterns and/or it would have been obvious to modify the invention of Hongo et al. '759, Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) and Gelbart et al. '818 as discussed above by using beam division with independent control of the individual beams to increase productivity in forming masks as taught by Jensen et al. '718 without any thermal effects as discussed by Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999).

The rejection stands without further comment beyond those presented above.

7. Claims 1-4, 9-12, 24-31 and 35-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongo et al. '759, Haight et al., "MARS:Femtosecond laser mask advanced

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repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999)) and Gelbart et al. '818, in view of Zhang et al., "Study of microprocessing of glass", Proc. SPIE vol. 3933 pp. 332-337, Okamoto '606, Ito JP 2000-056112 and Hayashi '683.

Zhang et al., "Study of microprocessing of glass", Proc. SPIE vol. 3933 pp. 332-337 teaches the use of laser machining to form phase shifting grating structures.

Okamoto '606 teaches the use of ion beams to etch both the metal layer and the substrate to form a phase shifting groove at the same time to save time. (18/47-52)

Ito JP 2000-056112 (machine translation attached) teaches the use of femtosecond laser pulses to cause refractive index changes within the glass substrate. [0011-0012]. The location of the changes are controlled by the focused position of the laser beam during a scanning process. [0013-0014].

Hayashi '683 teaches marking glass using lasers. The formation of subsurface marks is disclosed as desirable over ablation due to the absence of debris and cracking. (1/20-29). The division of the beam and focusing of the various beamlets at the same point is disclosed.

In addition to the basis provided above, the examiner holds that it would have been obvious to one skilled in the art to modify the invention of Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) by using the laser disclosed by Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) as able to damage the substrate to form phase shifted regions in the substrate in the manner taught by Ito JP 2000-056112 and Hayashi '68 to form phase shifted areas similar to those of Zhang et al., "Study of microprocessing of glass",

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Proc. SPIE vol. 3933 pp. 332-337 to save time in photomask manufacture as taught by Okamoto '606 without the formation of debris or cracking of the substrate material.

8 Claims 1-4,9-12, 24-31 and 35-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongo et al. '759, Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999)) and Gelbart et al. '818, in view of Zhang et al., "Study of microprocessing of glass", Proc. SPIE vol. 3933 pp. 332-337, Okamoto '606, Ito JP 2000-056112 and Hayashi '683, further in view of Lou et al. '272.

In addition to the basis provided above, the examiner holds that it would have been obvious to one skilled in the art to modify the combination of Hongo et al. '759, Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) and and Gelbart et al. '818 by adding an AR coating as disclosed by Lou et al. '272 to be useful in laser machining of chromium masks.

The rejection stands without further comment beyond those presented above.

9 Claims 1-4,6-12, 24-31 and 33-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over James et al. '200 combined with Hongo et al. '759, Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999), Gelbart et al. '818 and Jensen et al. '718, in view of Zhang et al., "Study of microprocessing of glass", Proc. SPIE vol. 3933 pp. 332-337, Okamoto '606, Ito JP 2000-056112 and Hayashi '683

In addition to the basis provided above, the examiner holds that it would have been obvious to one skilled in the art to modify the invention of James et al. '200 combined with

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Hongo et al. '759, Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999), Gelbart et al. '818 and Jensen et al. '718 by using the laser disclosed by Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) and Ito JP 2000-056112 as able to damage the substrate to form phase shifted regions in the substrate in the manner taught by Ito JP 2000-056112 and Hayashi '68 to form phase shifted areas similar to those of Zhang et al., "Study of microprocessing of glass", Proc. SPIE vol. 3933 pp. 332-337 to save time in photomask manufacture as taught by Okamoto '606 without the formation of debris or cracking of the substrate material.

10 The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Aitken et al. '036 teaches femosecond laser processing of glasses to form waveguides and the like.

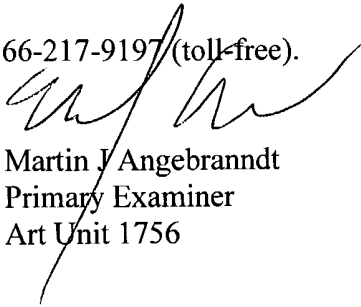
Tatah et al. '560 teach laser processing to cause marks of either damage or phase changes within the transparent material.

11 Any inquiry concerning this communication or earlier communications from the examiner should be directed to Martin J Angebrannndt whose telephone number is 571-272-1378. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Martin J. Angebranndt
Primary Examiner
Art Unit 1756

07/14/2004